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ABSTRACT

Study effect meta-analysis was used to synthesize the results of explicit instruction on critical thinking (CT). The approach involved the collection of 250 studies (books, articles, dissertations, and abstracts) from the ERIC database and "Dissertation Abstracts International", coding of the study features, calculation of effect sizes, and examination of relations between study features and effect sizes. To be included in the meta-analysis, studies had to compare the performance of two groups of students on some measure of CT. One group received explicit instruction to improve CT, while the other group did not. Each study was coded for its characteristics within three categories: publication history, methodological and setting features, and instructional features. Instructional variables were duration of instruction, subject matter of the course in which the instruction was given, and presentation of instruction via the teacher or some other medium. Programs that focused continuously on thinking skills were distinguished from those that addressed such skills periodically. Programs that taught CT in a subject matter domain were distinguished from those that taught CT generally. Finally, the content of programs was coded as addressed to either internal or external consistency. A total of 20 studies, 19 of which were doctoral dissertations, were found to be suitable for the meta-analysis. Results consistently favored programs that used explicit instruction methods. Intensive programs proved more effective than did programs providing only periodic training in CT. Length of treatment was unrelated to effectiveness. When the content of the CT instruction was internal validity, the average effect size was significantly lower than when both internal and external validity were emphasized. (TJH)

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Meta-analysis of effects of explicit instruction for critical thinking

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Critical thinking, the ability and willingness to test the validity of propositions, has long been held as a desirable product of education. Liberal arts education, for example, is often defended for its presumed capacity to develop adaptable thinkers to meet any variety of societal challenges. In a 1984 report, the National Institute of Education identified critical thinking as one of the highest priorities of college education in general (as cited in McMillan, 1987). Many professions, from nursing to law to science, identify critical thinking as a crucial skill of its practice. And critical thinking is regarded by many as a fundamental quality of good citizens of democracy.

There is no such agreement, however, about the exact nature of this ability. Critical thinking has been equated with intelligence, domain-specific expertise, problem-solving, reading comprehension, logic and sound reasoning, and other higher order mental activities. This disagreement reflects the complexity of this construct. Critical thinkers must have sufficient information about a proposition to permit its evaluation. Critical thinkers must also be self-evaluative, knowing when their information is incomplete or faulty and where to find reliable sources of information. Critical thinkers must have an arsenal of analytical, problem-solving, and inquiry skills available to decompose complex arguments or information into simpler components, generate hypotheses and questions about the components, and then submit these components to careful scrutiny. Finally, critical thinking has an attitudinal aspect. That is, critical thinking is not merely problem-solving algorithm, but is

an inquisitive disposition toward experience, a predisposition to intellectually act in a consistent way over time and in different situations.

Given this complex of declarative, procedural, meta-cognitive, and attitudinal aptitudes, one would expect that critical thinking would develop only after years of sustained educational effort. Yet there are numerous studies of the effects of relatively brief interventions on critical thinking. The results of these programs have been mixed. Ennis (1989) categorizes instruction for critical thinking into 3 models: general, infusion, and immersion. The general model attempts to explicitly teach general critical thinking skills. The infusion model may also explicitly teach critical thinking skills, but in the specific context of some subject matter domain. The immersion model suggests that critical thinking is best developed by encouraging a deep understanding of a subject matter domain, not by explicit instruction. According to Ennis, there is not enough evidence yet to suggest that any one of these approaches is better than the other, though he expresses some reservations about the rationale underlying the immersion model.

McMillan (1987) examined 27 evaluations of educational effects on college students' critical thinking. He concluded, "The results failed to support the use of specific instructional or course conditions to enhance critical thinking but did support the conclusion that college in general appears to improve critical thinking." McKeachie, Pintrich, Lin, and Smith (1987) disagreed with McMillan's assessment. They attributed improvement in

critical thinking to three instructional variables: student discussion, explicit emphasis on problem-solving procedures, and explicit emphasis on methods to encourage development of meta-cognition.

Nisbett and his colleagues (Nisbett, Fong, Lehaman, & Cheng, 1987) have suggested a very different kind of explicit instruction for the promotion of critical thinking. They have argued that higher order thinking is neither task-specific nor formally logical, but the result of repeated practical experiences with situations that demand certain patterns of thinking. These abstracted patterns of well-practiced cognition are called pragmatic reasoning schemas. Nisbett argues that pragmatic reasoning schemas can be enhanced by relatively brief, explicit instruction about the schema.

We employed meta-analysis to synthesize the results of explicit instruction on critical thinking. We hoped to obtain an accurate impression of the overall success of such programs and, hopefully, some insight into specific instructional features that might be most effective. We used study effect meta-analysis (Bangert-Drowns, 1986), an adaptation of the meta-analytic techniques originally proposed by Gene Glass (Glass, McGaw, & Smith, 1981). This approach involves four phases: the collection of studies, coding of the study features, calculation of effect sizes, and examination of relations between study features and effect sizes.

Method

We searched the keywords "critical thinking" with "instruction" and "research" in the ERIC database and Dissertation Abstracts International. As we obtained useful reviews and studies, we examined their bibliographies for leads to other studies. In all, we examined approximately 250 books, articles, dissertations, and abstracts. Many of these were conceptual or philosophical articles, others were correlational studies, still others investigated educationally relevant variables that were not specific to instruction.

To be included in the meta-analysis, studies had to compare the performance of two groups of students on some measure of critical thinking. One group received instruction to improve critical thinking, the other did not. The instructional intervention had to be explicit instruction. That is, the concepts or skills to be taught were explicitly labelled and discussed, and students were led through practice on the use of this content. Of course, studies also had to report sufficient information for the calculation of effect sizes.

Each study was coded for its characteristics in three categories: publication history (study source and publication date), methodological and setting features (e.g., method of subject assignment, use of same or different teachers in experimental and control treatments, grade level), and instructional features. Two instructional variables were the duration of instruction and the subject matter of the course in

which the instruction was delivered. Another variable recorded whether instruction was given by the teacher or through some media. Critical thinking programs that continuously focussed on thinking skills were distinguished from those who only periodically addressed them. Programs that taught critical thinking in a subject matter domain were distinguished from those that taught critical thinking generally. Finally, the content of the critical thinking program was coded as either addressed to internal consistency (examining the quality of logic, reasoning, or argumentation), external consistency (examining the quality of evidence for a proposition), or both.

Effect sizes were calculated for measures of critical thinking. An effect size is the difference between experimental and control group means divided by the standard deviation of the control group. Where means and standard deviations were not available, techniques described in Glass, McGaw, and Smith (1981) were used to compute effect sizes from other available statistics, like F- and t- values. To preserve the independence of the datapoints, only one effect size was calculated for each study.

Results

Twenty studies were found to be suitable for this meta-analysis. Nineteen of these studies were doctoral dissertations. All used a general measure of critical thinking as the final criteria. Ten used the Watson-Glaser Critical Thinking Appraisal, and five used the Cornell Critical Thinking Test.

The most obvious result of this review was the general success of explicit treatment to produce improvement on tests of critical thinking. Findings from eighteen of the twenty studies favored critical thinking instruction, eight significantly. Only two studies produced negative findings, and these were nonsignificant. The average effect size was statistically and practically significant, 0.37 standard deviations. This is equivalent to increasing student performance from the 50th to the 64th percentile.

Only one variable was found to be significantly related to effect size. When the content of the critical thinking instruction was internal validity (logic, reasoning, and the like), the average effect size (0.03 standard deviations) was significantly lower than when both internal and external validity were emphasized (0.55 standard deviations). Programs that emphasized external validity produced an intermediate effect (0.40 standard deviations), but this finding was based on only three studies.

Two other variables were related to effect size with borderline significance ($p=.11$). Student in younger grades benefitted more from critical thinking instruction than did students in high school and college. The average effect size for elementary and junior high grades was 0.50 standard deviations, for high school and college, 0.21 standard deviations. We also found that programs that concentrated continuously on critical thinking were more successful than programs which periodically emphasized critcal thinking. Continuous programs produced an average effect

size of 0.47 standard deviations. Programs that periodically addressed critical thinking produced an average effect of 0.15 standard deviations.

Discussion

It is most striking that the studies reviewed in this meta-analysis so consistently produced findings favorable to explicit instruction in critical thinking. Eighteen of twenty studies produced positive findings, and all twenty yielded a respectable effect size of 0.40 standard deviations. Of course, this does not necessarily mean that critical thinking itself is so easily increased. Though instructed students did better than uninstructed students on paper-and-pencil tests of general critical thinking ability, they may not be able or willing to use these skills in natural, everyday situations. Even so, that relatively brief interventions could result in such noticeable improvement in critical thinking test performance is impressive.

Six of the studies employed instructional programs that focused primarily on assessing the internal validity (logic, reasoning, etc.) of propositions. Four of these taught logic through explicit instruction, two concentrated on improving performance on test items typically used to measure thinking and intelligence. These programs proved least successful in promoting critical thinking skill. Students of explicit instruction that addressed matters of both internal and external validity, on the other hand,

performed half a standard deviation better than their uninstructed counterparts.

Substantial evidence indicates that humans do not use formal logic to solve everyday problems, and therefore teaching logic may be too obscure and seemingly irrelevant to enhance critical thinking. On the other hand, Nisbett, Fong, Lehman, and Cheng (1987) argued that people seem to possess relatively general informal thinking skills that are presumably generalized from repeated experience with situations of particular types. Cheng, Holyoak, Nisbett, and Oliver (1986) showed that these pragmatic reasoning schemas could be enhanced with even short instructional interventions.

Assessing the trustworthiness of a statement, that is, its external validity, is a common demand of even young children's lives. This meta-analysis showed that instruction in this pragmatic reasoning skill, even when combined with instruction on logic, is more effective than teaching formal logic alone. The existence of pragmatic skills for assessing external validity may explain why children in younger grades seem to especially benefit from the instruction. High school and college students have practiced these pragmatic skills for a longer time and instruction might be expected to have a smaller influence on their thinking than on younger, less experienced students.

We found tentative evidence that more intensive programs, ones that continuously emphasize critical thinking, do better than programs that only periodically address critical thinking. Interestingly, we found no evidence that length of treatment is

related to the effects of treatment. It is also worth noting that critical thinking programs embedded in specific subject matter instruction (what Ennis [1989] calls "infusion" programs) do no better than general explicit instruction for critical thinking. Of course, the tests used in these studies were measures of general critical thinking. It is possible that the effects of content-embedded critical thinking instruction would appear only on tests requiring application to the content.

Bibliography

Bangert-Drowns, R. L. (1986). A review of developments in meta-analytic method. *Psychological Bulletin, 99,* 388-399.

Cheng, P., Holyoak, K. J., Nisbett, R. E., & Oliver, L. M. (1986). Pragmatic versus syntactic approaches to training deductive reasoning. *Cognitive Psychology, 18,* 293-328.

Ennis, R. H. (1989). Critical thinking and subject specificity: Clarification and needed research. *Educational Researcher, 18* (3), 4-10.

Glass, G. V., McGaw, B., & Smith, M. L. (1981). *Meta-analysis in social research.* Beverly Hills, CA: Sage Publications.

McKeachie, W. J., Pintrich, P. R., Lin, Y.-G., and Smith, D. A. F. (1986). Chapter 4, Student motivation. In *Teaching and learning in the college classroom: A review of the research literature.* Ann Arbor, MI: National Center for Research to Improve Postsecondary Teaching and Learning.

McMillan, J. H. (1987). Enhancing college students' critical thinking: A review of studies. *Research in Higher Education, 26,* 3-27.

Nisbett, R. E., Fong, G. T., Lehman, D. R., & Cheng, P. W. (1987). Teaching reasoning. *Science, 238,* 625-631.